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METHOD OF RESURFACING ROADS AND BRIDGE DECKS

Field of the Invention

The invention relates to the field of road surface repair and in particular the repair of concrete bridge decks.

Background of the Invention

It is a common occurrence for roads to become worn due to traffic. Wearing of roads can cause the concrete and asphalt road surfaces to become smooth and slick. Asphalt road surfaces can become rutted due to the combination of high temperatures and heavy trucks. These factors cause unsafe driving conditions. Other factors such as oil or other fluids leaking from vehicles can also create slick surfaces even when the smooth surfaces are otherwise dry. Concrete bridge decks also are subject to transverse cracking which allows water to seep in and corrode the steel reinforcing within the concrete bridge deck. Spalling is another defect in concrete bridge decks which causes the surface of the concrete to crumble leaving the aggregate

exposed.

Resurfacing of worn bridge decks has utilized various methods. One expensive and time consuming method includes shot blasting the top portion of the concrete pavement to create high friction surface. This procedure involved causes damage to the concrete. Another repair method is the application of a thin coating of epoxy resin mixed with aggregate. Neither method is effective in filling in ruts or potholes or cracks.

Prior methods of road resurfacing and bridge deck repair are not as readily adaptable to providing added improvements to the pavement such as anti-ponding lines or ice preventing devices.

In view of the forgoing it can be seen that there is a need for a new method of road surface repair that is suitable for use in repair of bridge decks that avoids long traffic delays and provides a long lasting repair.

Objects and Summary

One object of the invention is to provide a bridge deck resurfacing material formed of a layer or layers of cementitious material and rock chips to provide a long lasting and high friction surface.

Another object of the invention is to provide a method of applying the materials to the road surface quickly to avoid long traffic delays.

Yet another object of the invention is to provide a method of filling in potholes prior to resurfacing the road.

Still another object of the invention is to provide a high friction road surface.

Yet another object of the invention is to provide anti-ponding lines in the road surface.

Another object of the invention is to provide anti-icing devices embedded in the road surface.

In summary, this invention is directed to the resurfacing of roads and in particular bridge decks. The invention includes spreading with a squeegee a thin layer of polymer modified concrete over a bridge deck surface and then applying by broadcasting a layer of granite rock chips to the wet concrete to provide a high friction surface. An optional second layer of the polymer modified concrete is then applied over the first layer of rock chips using the squeegee and an optional second layer of rock chips is then broadcast over that layer and then heavy quartz sand may be applied. If spalling or potholes are present in the road surface, these defects are repaired prior to the road resurfacing. Repair of potholes is accomplished by mixing granite aggregate rock chips with polymer modified concrete to form a putty which is then screeded into the potholes.

Other improvements can be added to the bridge deck during the resurfacing process such as anti-ponding lines to facilitate runoff of water from the road surface and reduce hydroplaning. The lines create a series of grooves in the pavement surface extending from the centerline to the edge of the road perpendicular to the direction of travel.

De-icing devices may also be added during the resurfacing project to prevent snow and ice from building up on the road surface. Electric resistance heating elements are placed on the highway surface and covered with polymer modified concrete. The heating elements are preferably connected to solar cells and/or batteries or an electric generator to provide electricity to heat the road surface to sufficient temperature to prevent ice and snow from accumulating on

the heated road surface.

Other objects, uses and advantages will be apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof.

Brief Description of the Drawings

Figure 1 is a perspective view of a bridge deck in need of repair.

Figure 2 is a view of the bridge deck of figure 1 having potholes, spalling and cracks repaired prior to application of the resurfacing material.

Figure 3 shows the application of the polymer modified cement to the bridge deck;

Figures 4 - 7 show the repair of a road surface in sequential cross-sections.

Figure 8 shows a bridge deck having sections broken away to reveal layers.

Figure 9 shows a bridge deck having heating wires placed in the wheel lanes prior to application of the resurfacing materials.

Detailed Description of the Invention

Figure 1 shows a bridge deck 10 having defects 12 therein. Prior to resurfacing the bridge deck 10 these defects 12 (i.e. potholes, spalling, transverse cracks or popouts, etc.) must first be repaired. This is accomplished by filling in the defects with a mixture of polymer modified concrete and rock chips. The polymer modified concrete is preferably made by mixing 330 resin manufactured by Rohm & Haas with Quik Krete cement powder at a ratio of two gallons of resin per sixty pound bag of powder. The rock chips are preferably granite chips in sieve size "0" (1/4" x 1/8") and in the defect repair portion of the bridge deck resurfacing

project are mixed with the Quik Krete and resin to form a putty 14 and screeded into the defects 12 to form a level road surface 16 as shown in Figure 2. The rock chip and resin mixture is then allowed to set up. The time to set up will vary depending on weather conditions, but will generally be less than an hour.

Next the polymer modified concrete 18 is applied to the road surface 16 of the bridge deck 10 as shown in Figure 3. The polymer modified concrete layer 18 is applied to the road surface 16 using a squeegee machine 20 such as that described in my prior U.S. Patent No. 5,735,952. The squeegee machine 20 preferably uses a 12 foot wide squeegee 22 as shown which can cover an entire traffic lane in one pass with a thin coating of 1/8 inches to 1/16 inches of polymer modified concrete.

Still looking at Figure 3, a layer of rock chips 24 is applied while the polymer modified concrete layer 18 is still wet. The rock chips 24 are applied by broadcasting using an air blower 26 giving the rock chips 24 enough velocity to embed into the polymer modified concrete layer 18. The rock chips 24 are preferably applied by using a blower on the shoulder lane next to the lane on which the polymer modified concrete layer 18 has been laid and blowing the rock chips 24 onto the polymer modified concrete layer 18. The polymer modified concrete layer 18 is then allowed to dry. This period may vary according to weather conditions, but generally is about 1 and 1/2 to 2 hours. Any loose rock chips are then blown off by an air blower 27. Figures 4 - 7 show sequential cross-sections of the road surface 16 as first the putty 14 is applied, then the polymer modified concrete layer 18 and finally the rock chips 24.

Figure 8 shows a completed bridge deck resurfacing with portions broken away to reveal the layers 18, 24, 28 and 30 of resurfacing material. A second layer of polymer modified

concrete 28 is applied over the first layer of rock chips 24. The second layer of polymer modified concrete 28 is of the same thickness as the first layer 18. Next a second layer of rock chips and optionally heavy quartz sand 30 is applied to the second layer of polymer modified concrete 28 using the blower technique described above.

The process is repeated for each travel lane until the entire bridge deck 10 is resurfaced. The resurfaced lanes can be driven on in about 1 1/2 to 2 hours, but the polymer modified concrete layers 18 and 28 will continue to cure for about seven days.

Referring now to Figure 9, resurfacing bridge decks in this manner provides an ideal opportunity to install de-icing devices in the pavement 32. Prior to my invention applications of de-icing devices could be installed only as part of new construction. Now, with my invention, de-icing devices may be installed on existing bridge decks and road surfaces.

As shown in Figure 6, heating elements 34, preferably in the form of copper wires of sufficient diameter to be durable and produce heat to warm the pavement 32 enough to melt ice and snow are placed on the wheel lanes 36 of the pavement 32 after application of the first polymer modified concrete layer 38. Layer 38 is shown as applied in three foot wide stripes covering the wheel lanes 36 of the pavement 32. However, it should be understood that the first layer 38 could cover the entire lane and the heating elements 34 could also be applied across the whole lane. The heating elements 34 are preferably laid in a grid pattern as shown in Figure 6, but could also be placed in a zigzag pattern. Preferably, power is provided to the copper wires by batteries 40 and photovoltaic solar cells 42. However, power could also be provided by conventional power lines or a generator (both not shown). A thermostat may be applied to the heating elements 34 to maintain a desired temperature of the road surface during sub-freezing

weather. Preferably, the thermostat would be set at a temperature of about 40 degrees Fahrenheit so that the heating elements 34 will be activated when the surface temperature dips below 40 degrees.

After the heating elements 34 are installed and first polymer modified concrete layer 38 is allowed to dry, a second layer of polymer modified concrete 44 is applied over the entire wheel lane 36 covering the heating elements 34. Layer 44 may also be applied to the entire road surface. Then a layer 46 of rock chips and heavy sand is broadcast by blowing onto the polymer modified concrete layer 44 to embed the rock chips and sand into the top of the wet concrete. The concrete layer 44 is allowed to dry prior to traffic being allowed to travel over the roadway.

Figure 3 also shows the application of anti-ponding lines 48 to the polymer modified concrete layer 18. The anti-ponding lines 48 are formed in the polymer modified concrete layer 18 immediately after the application of the layer 24 of rock chips is broadcast onto the polymer modified concrete layer 18 but while the polymer modified cement 18 is still wet. The polymer modified concrete layer 18 is preferably one-eighth to one -quarter inches in thickness which will facilitate deeper lines 48. The lines 48 are formed simply by drawing a rake 50 across the travel lane 52 to provide evenly spaced lines 48 perpendicular to the direction of travel. The lines 48 create parallel shallow grooves 54 spaced approximately three-fourths of an inch to one inch apart which facilitate water flow off the bridge deck 16 and helps prevent ponding.

While this invention has been described as having a preferred design, it is understood that it is capable of further modifications, uses and/or adaptations of the invention following in general the principle of the invention and including such departures from the present disclosure as come within the known or customary practice in the art to which the invention pertains and

as maybe applied to the central features hereinbefore set forth, and fall within the scope of the invention and the limits of the appended claims.